Tool for Material-Removing Machining of Workpieces

Description

[0001] The invention concerns a tool for material-removing machining of high-strength workpieces according to the claims. The designation "high-strength materials" will be used below not only in reference to materials that by nature have a high degree of strength but rather also those which have a high degree of strength or hardness as a result of special treatment methods, in particular hardened workpieces such as hardened steels.

[0002] Tools of the type referred to here are known. They serve to machine workpiece surfaces, in particular drilled surfaces in workpieces to be machined which consist of high-strength materials. In order to remove the chips, the workpiece or the surface to be machined is brought past a blade plate of the tool so that the blade plate removes chips from the surface of the workpiece. In the machining of drilled surfaces, the workpiece is set in rotation and the stationary, also designated as tool is introduced into the drilled hole. It has been found that in the machining of high-strength materials, vibrations often occur which result in chatter. As a result, the machined surface of the workpieces does not have particularly good surface quality. That is, grooves and riffles can be detected which in many cases are not acceptable.

Summary of the Invention

[0003] The task of the invention therefore is to create a tool of the type mentioned which does not have these drawbacks. To solve this task, a tool of the type mentioned above is proposed which has the features mentioned in the claims. It is distinguished in that the blade plate is fastened to the tool with the aid of a clamping lug which engages in a groove on the blade breast. The clamping lug presses the blade plate tightly against the tool or its base body. Because the blade plate is provided with a groove, it is ensured that it can be fixed to the tool in a specified position which makes possible vibration-free machining of the workpiece.

[0004] An exemplary embodiment of the tool is preferred which is distinguished in that its base body has a projection which serves as a support. This [projection] is configured so that it supports the blade plate practically over its entire back side, i.e., on the side turned away from the clamping lug. This results in the blade plate being held especially reliably to the tool and vibrations being avoided.

[0005] Especially preferred is an exemplary embodiment of the tool that is distinguished in that it is configured as one piece. This leads to a special stability of the tool and thus to a vibration-free application. In particular as a result of this, chattering can be reliably avoided during material-removing machining of workpieces. Additional embodiments are found in the other subclaims.

Brief Description of the Drawings

[0006] The invention will be explained in greater detail below with the aid of the drawings.

[0007] Figure 1 shows a side view of the tool;

[0008] Figure 2 shows a top view of the tool according to Figure 1 in reduced scale;

[0009] Figure 3 shows a front view of the tool; and

[0010] Figure 4 shows a detail enlargement of the blade plate.

Detailed Description

[0011] Tool 1 depicted in Figure 1 comprises a base body 3 with a shaft 5 which serves to fasten tool 1 to a tool holding fixture or an adapter, intermediate piece or the like. Shaft 5 has a smaller diameter that the adjoining area of base body 3 so that an end face 7 is formed which preferably is ring-shaped and serves to ensure that in mounted condition, tool 1 reliably contacts the mount, intermediate piece, adapter, or the like.

[0012] On the side opposite the shaft, an area 9 of the base body is provided, the outside diameter of which is less that the portion lying between area 9 and shaft 5 of tool 1. In area 9, a blade plate 11-shown here in top view and triangular in form-is provided which with the help of a clamping lug 13 is tightly fastened to base body 3 of tool 1. It is suggested through an x that clamping lug 13 is fastened to base body 3 by means of a clamping screw. Around one third of blade plate 11 projects over the circumferential surface 17 of area 9 of tool 1 and in the area which projects the farthest has a cutter 19. It is suggested here by crosshatching that in the area of cutter 19, an insert 21 is provided

which is distinguished through a special hardness and resistance to wear. It can be of ceramic material, diamond, or CBN.

[0013] Blade plate 11 is rounded in the area of cutter 19. Here there is a radius of curvature of 2.2 mm to 2.7 mm. A radius of curvature of approximately 2.5 mm has proven especially effective, being distinguished in that the blade plate is very stable and has little susceptibility to breakage and in particular induces little vibration when a workpiece of high-strength material is machined. In addition, as a result of the rounding in the area of cutter 19, it is ensured that in the machining of interrupted drilled surfaces, the cutter is not damaged.

[0014] The area of clamping lug 13 facing away from cross mark 15, which area is also designated clamping lip 23, rests on the front side of blade plate 11 which faces the observer and which in the contact area with clamping lip 23 is provided with a preferably continuous groove 25. Groove 25 serves to hold blade plate 11 by means of positive fit. It can be fabricated in blade plate 11 in a simple manner through a grinding process.

[0015] Groove 25-viewed from above-runs essentially parallel to the middle axis 27 of tool 1 and is arranged as close as possible to cutter 19 in order to minimize the chance of vibrations. As a result of the interplay between groove 25 and clamping lip 23 it is ensured that blade plate 11 is held secure against twisting on base body 3 of tool 1. As a result, cut properties which have once been specified are reliably retained and chattering or vibrations are avoided.

[0016] Area 9 of base body 3 is provided on the side opposite blade plate 11 with a sloping area 29 which facilitates introduction of tool 1 into a drilled hole to be machined.

[0017] In Figure 1, an opening 31 of one of channels 33 fabricated into base body 3 is also suggested which ultimately opens-which is not shown in the figure-into a drilled hole 35 which here runs concentrically with the middle axis 27 in base body 3. Air is fed under pressure into this drilled hole in suitable manner which in operation of tool 1 exits out of opening 31 and carries chips out of the processing area of blade plate 11.

[0018] It is clear from the depiction according to Figure 1 that the width of clamping lug 13 in the area of groove 25 is selected such that clamping lip 23 rests on the front side of blade plate 11 practically over its entire width. Thus an optimal position fixing of blade plate 11 to base body 3 of tool 1 and a high rigidity of clamping lug 13 are ensured. Through a corresponding configuration of clamping lip 23 it is also ensured that clamping lug 13 does not project laterally over blade plate 11. The width of clamping lip 23 is selected here such that it lies within the incircle of blade plate 11.

[0019] Figure 2 shows tool 1 of Figure 1 in top view so that the observer here looks down on blade plate 11. Parts that have already been explained using Figure 1 are provided with the same reference numbers so that the preceding explanation can be referred to. It can be recognized in Figure 2 that between base body 3 and blade plate 11, a spacer 37 can be provided which in turn in suitable manner is fastened to base body 3 of tool 1, for example by means of a screw that penetrates intermediate spacer 37 and engages into base body 3 of tool 1. The contour of spacer 37 preferably is adapted to that of blade plate 11. Therefore an essentially triangular spacer 37 is selected here, the size of which corresponds practically to that of blade plate 11 so that the entire surface of the latter up to the area of cutter 19 can rest on spacer 37. Spacer 37 is supported on its side

away from blade plate 11 by a support 39 projecting across circumferential surface 17 which ensures that forces introduced into blade plate 11 through cutter 19 during machining of the workpiece are intercepted and conducted into base body 3 of tool 1.

[0020] It can be seen in the top view in accordance with Figure 2 that blade plate 11 does not project out of circumferential surface 17 of tool 1 over its entire width. It can be seen that the side of blade plate 11 turned away from face side 41 of tool 1, base body 3 projects beyond blade plate 11 in a section 43.

[0021] The top view according to Figure 2 also shows that front side 45 of blade plate 11 does not run parallel to middle axis 27 but rather forms an acute angle with it which opens from face side 41 in the direction toward shaft 5 and preferably is in a range from 4° to 8°, in particular approximately 6°. As a result of this acute angle, during machining of a workpiece, a flow of chips is ensured such that vibrations and oscillations are reduced to a minimum. Figure 2 also shows that cutter 19 of blade plate 11 is on a plane that intersects middle axis 27.

[0022] Above middle axis 27, in the area of blade plate 11 and adjoining to the left, a recess is provided in base body 3 of tool 1 which serves as chip space 47. Chips which are removed from the workpiece run into this area. Preferably clamping lug 13 is arranged sunk in base body 3 of tool 1 such that it does not project into chip space 47 and does not negatively impair the flow of chips.

[0022] It can be seen from Figures 1 and 2 that clamping lug 13 is configured as a prism. It also has, extending from the clamping screw suggested by cross mark 15, two lateral surfaces 49 and 51 which run at an acute angle. These [lateral surfaces] serve to

anchor clamping lug 13 in the tightened condition so as not to twist in base body 3 of tool 1 and thus to ensure a defined alignment of blade plate 11 which is held by means of form fit.

[0023] In the top view according to Figure 3 on face surface 41 of tool 1, parts of the tool are broken away. As a result, clamping lug 13 can easily be recognized which rests with its clamping lip 23 on the front side 45 of blade plate 11.

[0024] In Figure 3, a clamping screw 53 can be clearly recognized that has two threaded sections. A first threaded section engages in clamping lug 13 and a second in base body 3 of tool 1. Preferably the threaded sections are equipped with opposing threads. Clamping screw 53 runs at an acute angle to an imaginary vertical line V in order to securely fix blade plate 11 in base body 3. The latter, as can be seen n Figure 3, is arranged such that its cutter 19 touches an imaginary horizontal line H which, like vertical line V, intersects middle axis 27. The top view shows that blade plate 11 does not lie completely in a plane which coincides with horizontal line H. Instead, it is inclined at an acute angle of 4° to 8°, preferably approx. 6° such that front side up to cutter 19 is arranged above horizontal line H. This arrangement also serves to ensure an optimal chip flow during machining of workpieces and to avoid chattering or oscillations.

[0025] It can be seen from Figure 3 that support 39 is formed by a projection extending beyond circumferential surface 17 which extends as an arc above circumferential surface 17, specifically over an area of approximately 90°. Support 39 is thus especially capable of resistance and is configured such that the forces occurring during machining of a workpiece can be conducted reliably and with little oscillations into base body 3.

[0026] It is suggested with dashed lines in Figure 3 that spacer 37 is fastened to base body 3 of tool 1 by means of a screw 9, specifically in the area of support 39. Forces received by spacer 37 therefore are reliably and with little oscillation conducted through support 39 into base body 3 of tool 1.

[0027] In the scaled-down depiction according to Figure 3, groove 25 is not easily recognizable; therefore reference is made here to the detail enlargement presented in Figure 4 which shows blade plate 11 in front view as in Figure 3. An essential factor is that groove 25 has an edge F which inclines with respect to front side 45 of blade plate 11 and which rises in the depiction according to Figure 4 from left to right and encloses an angle with front side 45 of approx. 6° to 12°, preferably approx. 10°. Through edge F, the forces of clamping lug 13 are distributed such that a first force component presses blade plate 11 against spacer 37 and against support 39 so that blade plate 11 is held securely in base body 3 of tool 1. A second force component acts in the direction of middle axis 27 of tool 1 so that blade plate 11 can be rotatably fixed in a specified position.

[0028] It is clear from the enlarged depiction of blade plate 11 that for practical purposes it is not weakened through groove 25. Since blade plate 11 in addition is not penetrated for a clamping screw which otherwise is usual, it is very stable, which likewise leads to low-oscillation machining of workpieces and significantly increases tool life.

[0029] Let it be expressly pointed out here that base body 3 of tool 1 is configured as one piece. Thus this means that shaft 5 transitions over the middle section of tool 1, which is distinguished by a relatively large outside diameter, into the area 9 with a smaller diameter in which blade plate 11 is mounted. As a result of the one-piece

configuration of tool 1 it is ensured that during machining of a workpiece of blade plate 11 can be introduced with particular low oscillations into the holder of tool 1 so that chattering and oscillations can be avoided with high reliability during machining of the tool 1. Blade plate 11 therefore is very stable and is very low in oscillations in the machining of workpieces because it is held by means of a clamping lug and not by means of a screw penetrating through the blade plate.

[0030] Tool 1, which was explained with the aid of Figures 1 through 4, thus is distinguished by a special configuration which makes it possible to machine workpieces of high-strength materials with the aid of a blade plate 11 without oscillations occurring which would lead to an impairment of the workpiece surface which is to be machined and to a persistent shortening of the tool life. The interplay of various measures, specifically the one-piece configuration of tool 1, the reliable bedding of blade plate 11 through support 39, if applicable through a spacer 37, and the fact that support 39 projects over circumferential surface 17 of base body 3, finally the mounting of blade 11 to base body 3 of tool 1 so as not to twist produce outstanding machining results even, and in particular, when the workpiece is composed of high-strength materials. In order not to impair the material properties of tool 1 and of blade 11 as well as the workpieces to be machined which become very hot during machining, chips which are created are not carried away from the machining site by means of a coolant and/or lubricant but rather by means of air at overpressure which is conducted out of opening 31 onto the machining area.